

**REMARKS**

Claims 1-5 and 8-17 are pending in this application. The Office Action rejects claims 2, 8, 13 and 14 under 35 U.S.C. §112, second paragraph; rejects claims 1, 2 and 8 under 35 U.S.C. §102(b), or in the alternative, under 35 U.S.C. §103(a); and rejects claims 3-6 and 9-15 under 35 U.S.C. §103(a). By this Amendment, Applicants amend claims 1-4, 9, 13 and 14, cancel claims 6 and 8 and add new claims 16 and 17. Support for the amendments can be found in the specification as filed at, for example, at page 19, lines 10-35; page 25, lines 17-26; page 26, lines 1-26; and pages 29-30.

Applicants thank Examiner Wong for the courtesies extended to Applicant and Applicants' representatives on August 24, 2007. Applicants' separate record of the substance of that interview is contained in the following remarks.

**I.      Rejections Under 35 U.S.C. §112**

The Office Action rejects claims 2, 8, 13 and 14 under 35 U.S.C. §112, second paragraph. In particular, the Office Action asserts that, with respect to claim 2, "with phosphoric acid;" "the metal material article;" and "the ions" lack antecedent basis. With respect to claims 8, 13 and 14, the Office Action asserts that "with phosphoric acid;" "the gases;" and "-840 mV" lack antecedent basis. Applicants amend claims 1-4, 9, 13 and 14; cancel claims 6 and 8; add new claims 16 and 17; and respectfully traverse the rejection.

With respect to claim 2, instant claim 1, as amended, recites "...bath containing phosphate ions, phosphoric acid, nitrate ions, metal ions that form a complex with the phosphate ions..." Thus, the recitation of "metal ions that form a complex with phosphoric acid" in instant dependent claim 2 clearly contains antecedent basis. Moreover, instant claim 1 recites "a metal material article to be treated." Thus, the recitation of "the metal material article" in instant dependent claim 2 contains sufficient antecedent basis. Instant claim 2 has been amended to recite "the metal ions," as suggested in the Office Action.

Instant claim 8 depends from claim 1, and thus also clearly contains antecedent basis due to the recitation "...bath containing phosphate ions, phosphoric acid, nitrate ions, metal ions that form a complex with the phosphate ions..." in claim 1.

Instant claim 13 has been amended to recite "NO<sub>2</sub> and into N<sub>2</sub>O<sub>4</sub> present in the treatment liquid."

Instant claim 14 has been amended to recite "800 mV."

For at least the foregoing reasons, the subject matter of claims 2, 8, 13 and 14 contains sufficient antecedent basis. Reconsideration and withdrawal of the rejections are earnestly solicited.

## **II. Rejections Under 35 U.S.C. §102 And §103**

The Office Action rejects claims 1, 2 and 8 under 35 U.S.C. §102(b) as anticipated by, or in the alternative, under 35 U.S.C. §103(a), as obvious over, EP 1074640 A1 (hereinafter '640). The Office Action asserts that '640 discloses each feature of instant claims 1, 2 and 8 either expressly or inherently. Applicants amend claims 1-4, 9, 13 and 14; cancel claims 6-7; add new claims 16 and 17; and respectfully traverse the rejection.

Instant claim 1, as amended, includes a recitation of the following features: "a pH of less than 2;" "Fe is present and the amount of Fe ions dissolved in the treatment bath is controlled by changes in the amount of Fe ions dissolved into the treatment bath from a Fe electrode or a metal material article to be treated of a steel material;" "NO<sub>2</sub> and/or N<sub>2</sub>O<sub>4</sub> gas is substantially separated from the treatment bath;" and "ORP is 770 mV to 960 mV." As discussed in detail during Applicants' August 24 personal interview with Examiner Wong, these features, as combined, are critically important in substantially eliminating sludge formation, and are nowhere found, as combined, in '640. This combination of features also corresponds to the many examples involving a pH of less than 2 in the specification, as filed, and the conclusion that ORP should be raised and maintained at values higher than 770 mV.

See specification, as filed, for example, at Table 9, page 35; Table 14 showing Example 4; page 19, line 1; page 41 and page 43, lines 2-3; and page 44, lines 15-20.

In particular, when ORP is over 770 mV, dissolution of Fe proceeds to  $\text{Fe}^{3+}$ , whereas in the absence of such an ORP,  $\text{Fe}^{3+}$  solidifies and sludge forms. See specification, page 19, lines 10-35. By controlling the amount of Fe-phosphate complex that is replenished, the reaction from  $\text{Fe}^{2+}$  to  $\text{Fe}^{3+}$ , and its reverse reaction, are omitted. The resultant bath contains a stable  $\text{Fe}^{3+}$  complex. This replenishing of Fe-phosphate complex, in addition to pH, have a profound effect on ORP. See specification at page 25, lines 17-26; and page 26, lines 1-26. Additionally, the preferred ORP range is maintained by separating  $\text{NO}_x$  gases, i.e.  $\text{NO}_2$  and  $\text{N}_2\text{O}_4$ , from the treatment bath by, for example, circulating the bath in a manner so as to allow  $\text{NO}_2$  and into  $\text{N}_2\text{O}_4$ , to escape to the atmosphere. See pages 29 and 30. Each limitation of claim 1 thus plays an important role in prohibiting sludge formation.

In contrast, '640 discloses only a phosphate treatment method in which pH is broadly disclosed to be .5-5.0; and wherein ORP is broadly disclosed to be 200-1000 mV. In particular, '640 discusses the advantages of a wide pH range in order to accommodate a composition of the treatment bath. In fact, '640 specifically discloses a preference for pH higher than 4.0. See '640 at paragraph [0218]. Additionally, '640's overly broad disclosure of 200-1000 mV ORP fails to specify the criticality of an ORP of greater than 770 mV. Each of Examples 1-5 of Table 8 in '640 discloses an ORP of less than 400 mV. This makes sense because '640 discloses a method in which reactions for other than film formation occur in the bath. For example, Fe proceeds to  $\text{Fe}^{3+}$  which causes sludge. Nowhere does '640 disclose prohibiting the formation of excess  $\text{Fe}^{3+}$ , thereby prohibiting non-film forming reactions. Likewise, '640 nowhere discloses substantially separating  $\text{NO}_2$  and  $\text{N}_2\text{O}_4$  from the treatment bath.

Thus, '640 teaches directly away from the claimed pH and ORP, and nowhere discloses or suggests the claimed specific combination of pH and ORP values, in combination with 1) separating NO<sub>2</sub> and N<sub>2</sub>O<sub>4</sub> from the treatment bath, and 2) replenishing the Fe ions. Hence, '640 clearly nowhere discloses, inherently or expressly, the combination of the features or advantages of instant claim 1.

Furthermore, '640 fails to teach controlling the amount of Fe ions dissolved in the treatment bath as required by claim 1. For example, the amount of Fe ions dissolved in the treatment bath may be controlled by decreasing an electric current, as demonstrated in Example 1 of the instant specification. Example 1 describes using 0.6A in "anodic electrolysis" and "cathodic electrolysis Fe," while Example 1 set forth in '640 uses 28A and 51A in "anodic electrolysis" and "cathodic electrolysis Fe."

For at least the foregoing reasons, instant claim 1, from which all claims depend, is not anticipated by, nor would it have been obvious over, '640. Reconsideration and withdrawal of the rejection are earnestly solicited.

### **III. Rejection Under 35 U.S.C. §103(a)**

The Office Action rejects claims 3-6 and 9-15 under 35 U.S.C. §103(a) as unpatentable over '640, as applied above, and further in view of Matsuda (U.S. Patent No. 5,645,706). Applicants amend claims 1-4, 9, 13 and 14; cancel claims 6-7; add new claims 16 and 17; and respectfully traverse the rejection.

Instant claim 1, as amended, is patentable over '640 for the reasons stated above. Due to their dependency, all of claims 2-5 and 9-15 also are patentable over '640. Because this rejection relies upon the improper rejection of claim 1, this rejection is moot.

Moreover, Matsuda fails to remedy the deficiencies of '640 with respect to at least instant claim 1. Firstly, Matsuda is an *electroless* system in which sludge is invariably

precipitated due to the existence of reactants in solution phase. Matsuda is entirely different, as an *electroless* system, than the claimed *electrolytic* system.

As explained in detail by Mr. Matsuda himself during the August 24 personal interview, Matsuda's electroless system requires a promoter for the reaction; its ions exist in solution phase; the anode and cathode reactions occur on the same surface; and no NO<sub>2</sub> and/or N<sub>2</sub>O<sub>4</sub> gas is separated. Moreover, Matsuda attempts to create and maintain a condition in its chemical treatment bath that avoids sludge from forming by limiting phase transition only to the formation of the coating on the metal to be treated. See Matsuda, col. 7, lines 58-60. Matsuda concedes that it has not fully accomplished the removal of sludge insofar as it describes a second use for the filtering pump as "removal of the sludge which is produced in the treatment bath." See Matsuda, col. 8, lines 60-65.

In its failed attempt to adequately address the formation of sludge in the bath, Matsuda also describes a chemical bath having a pH of 2.0-4.0, preferably 2.5-4.0. See Matsuda, col. 8, lines 23-27 and col. 14, lines 27-28. Moreover, Matsuda requires a bath having an oxidation-reduction potential (ORP) of 460-860 mV. See Matsuda, col. 13, line 17. Accordingly, Matsuda's 13 examples are limited to a bath having a pH of more than 2.5 in combination with an ORP of less than 800 mV. See Matsuda's examples, col. 16-28. This combination of high pH and low ORP, as well as being an electroless system, undoubtedly contributes to Matsuda's sludge problem because, for example, Fe does not fully remain in solution in a bath having an ORP of below 770 mV, which is one reason that Matsuda's method *requires* a pump. See Matsuda, col. 8, lines 33-35.

For at least the foregoing reasons, instant claim 1, and all claims depending therefrom, are patentable over the combination of '640 and Matsuda. Moreover, there would not have been a reason to combine '640 and Matsuda, because doing so would not have obtained the

features of even instant claim 1. Reconsideration and withdrawal of the rejection are earnestly solicited.

**IV. Conclusion**

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-5 and 8-17 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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